



## **PROBLEM OF THE MONTH: February 2013**

### **MATHEMATICS**

Alice wants to buy a piece of land, exactly leveled, which would be bounded by four boundary lines, each measuring exactly 100 meters long; two boundary lines running exactly north-south, and two running exactly east-west. Can Alice buy such piece of land in the USA? State your reason.

### **PHYSICS**

There are two water fountains in a hallway, side-by-side. They are identical in every way except for the water pressure: The water stream of fountain A reaches 4 inches above the nozzle, and that of fountain B – 9 inches. Would it be faster to fill up a water bottle from fountain A or B? How much faster?

### **CHEMISTRY**

You decided to prepare sodium carbonate from baking soda. From the December POM you know that it can be prepared by heating baking soda in an oven. You placed 168 g of baking soda in a bowl, weighed it and recorded its weight. Then you put the bowl into a hot oven. After 1 hour you took the bowl and weighed it again. The bowl lost 31 g. You correctly concluded that the loss of weight was due to decomposition of the baking soda.

You know that this reaction proceeds in such a way that each molecule of baking soda decomposes independently on others, so the probability of each molecule's decomposing is constant (at given temperature).

Can you determine...

- i) Whether the decomposition complete?
- ii) If you answered “no” to part i, the amount of time the reaction needs to complete (assume the precision of your scales is 0.001g)?

## **BIOLOGY**

Some animals, such as chameleons, are able to change their skin color. The color change serves only partly for camouflage, turning chameleons invisible to their predators.

Please suggest other biological functions of color change in chameleons. Do you know of other animals able to change their skin color? Provide at least 4 examples of different animals with an ability to change color and explain why they do it.